Spectroscopic and Thermal Characterization of Encapsulated Agar in SiO_2 AND TiO_2 Sol-Gel

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Encapsulation of agar within ceramic materials has received much attention in order to obtain a medium to assess the viability of microorganisms in a friendly environment. One of the most interesting approaches is the use of agar as the host material. Agar comprises a family of cell-wall polysaccharides extracted from marine algae (Rhodophyte). Agar is a hydrophilic substance that has been extensively used as a gelation agent in food and in other applications in microbiology, biochemistry and biomolecular biology. The ability to form reversible gels simply by cooling hot aqueous solutions is the most important property of agar, which can be regarded as the prototype and model for all gelling systems. In this work the thermal and spectroscopic characterization of agar encapsulated in SiO_2 and TiO_2 sol-gel is presented. Optimal conditions for gelation were found for a molar relation of $[TEOS]/[H_2O] = 1/4$, and the relation for the solvent is $[TEOS]/[Solvent] = 1/4$ and pH= 7.5. A pyrex glass reactor was used and maintained in agitation up to the formation of the gel. Thermal properties of agar obtained from Gracilaria cornea from Yucatan, Mexico, are studied by a photopyroelectric technique. The detector was made with a 110mm PVDF. The cell was constructed in such a way that the sample was inside the cell, and the bottom of the cell was closed by the PVDF foil. Thermal effusivity as a function of temperature was obtained by illuminating the PVDF directly by a modulated 1W Tungsten lamp. The sample is enclosed inside of a chamber, using a Peltier cell that controls temperature in a range from 15°C to 60 °C. The sample is on top of the PVDF, which is illuminated by a modulated tungsten lamp. Optical properties of the system were also analyzed by infrared and Raman spectroscopy. The relevance of our results in the thermal stability of the systems is discussed.